

Appl. No. 09/897,572  
Atty. Docket No. 7949  
Amdt. dated May 3, 2004  
Reply to Office Action of February 3, 2004  
Customer No. 27752

### AMENDMENTS TO THE SPECIFICATION

Please amend the specification as follows:

Please replace the paragraph beginning at page 1, lines 6-8, with the following amended paragraph:

### CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority under [[37]] 35 U.S.C. § 119(a) to International Serial No. PCT/US01/04693, filed February 13, 2001 (~~Attorney Docket No. 7949~~); and further claims priority to U.S. provisional application no. 60/182,382, filed February 14, 2000.

Please replace the paragraphs beginning at page 7, line 8 – page 10, line 18, with the following paragraph:

### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1a is a flow diagram representing a process embodiment of the present invention having two process batteries preferably for use with petroleum wax.

Fig. 1b is a flow diagram representing a process embodiment of the present invention having two process batteries preferably for use with FISCHER-TROPSCH wax.

Fig. 2 is a flow diagram representing a process embodiment of the present invention having two process batteries.

Fig. 3 is a flow diagram representing a process embodiment of the present invention having three process batteries.

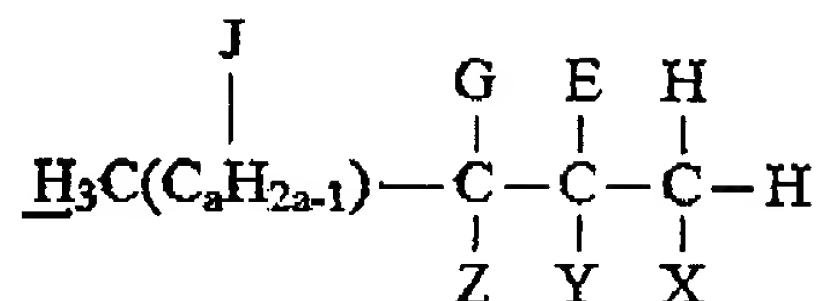
Fig. 4 is a flow diagram representing a process embodiment of the present invention having two process batteries with a distillation unit in one process battery.

Fig. 5 is a flow diagram representing a process embodiment of the present invention having an olefin/paraffin separator.

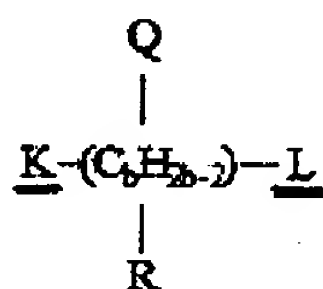
Fig. 6 is a flow diagram representing a process embodiment of the present invention having a wax isomerization unit.

Please replace the paragraph beginning at page 12, line 29, with the following amended paragraph:

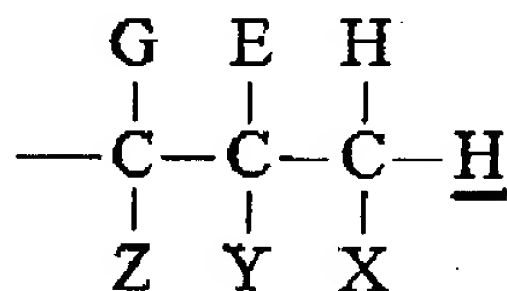
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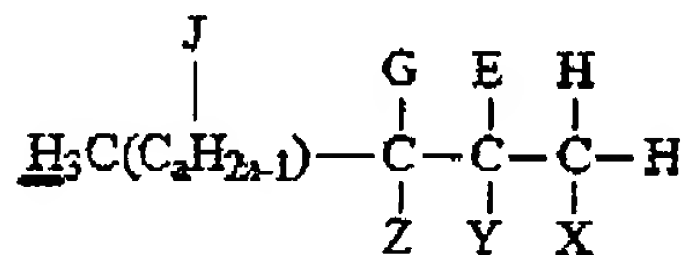
Please replace the paragraph beginning at page 17, line 13 , with the following amended paragraph:



Please replace the paragraph beginning at page 17, line 17, with the following amended paragraph:

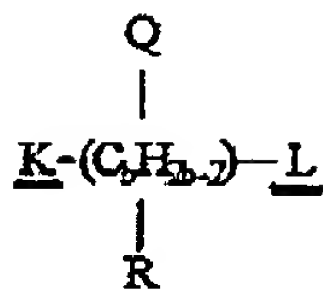


Please replace the paragraph beginning at page 18, line 10, with the following amended paragraph:

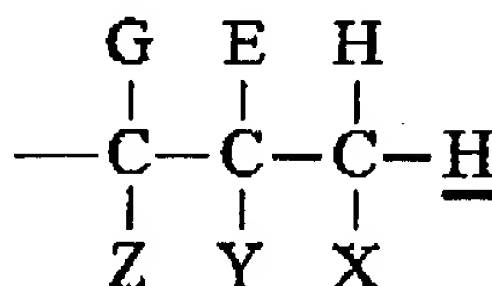


Please replace the paragraph beginning at page 24, line 1 , with the following amended paragraph:

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Please replace the paragraph beginning at page 24, line 4, with the following amended paragraph:



Please add the following new paragraphs after the paragraph beginning at page 34, lines 5 - 26:

A simple process embodiment of the present invention has two process batteries, e.g., A and B. Both of these batteries are present in each of Fig. 1a and 1b. The input stream, 1, differs in Fig 1a and Fig 1b. In Fig 1a, the input stream is suitably petroleum wax, and in Fig. 1b, the input stream is suitably Fischer-Tropsch wax. Such a process stream 1 is preferably derived from modern Fischer-Tropsch slurry-phase technology.

In each of Figs. 1a and 1b, the first battery, A, is a large-scale fuel-making battery, which includes the largest streams of the process in terms of volume. In each of Figs. 1a and 1b, the waxy stream, 1, is split and a portion is sent to battery B where it is cracked to long-chain alpha-olefins and paraffins in one or more steps shown as B(i), substantially in the absence of added hydrogen, unlike the main portion of stream 1 which is hydrocracked / hydroisomerized in one or more steps shown as A(i) in the presence of added hydrogen. (stream 22). Note that B(i) uses old detergent technology (which is not at all conventional at such long chain-lengths in modern fuel-making plants).

Once stream 10 from process unit B(i) has been secured, it is in accordance with the present invention to convert it to nonlinear primary aliphatic Oxo alcohols via, for example, isomerization in process unit or section B(iii), in Figs. 2, 3 and 5, by means of at least one Oxo reaction step in process unit or section B(iv) in Figs. 2, 3 and 5, and to further blend these alcohols with fuel hydrocarbons in a variety of different ways, for example as shown in blending battery C of Fig. 3.

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Another preferred process embodiment is nonlimitingly illustrated in Fig. 4, which differs from the other Figures in that the offtake from battery A to battery B is from the product distillate tower A(ii), i.e., at the back end of battery A.

Now in more detail with reference to Fig. 2, this shows a configuration in which the crackate stream, 10, is distilled to a narrow-cut, stream 11 in unit B(ii), which is skeletally isomerized (see, for example US 5,589,442 using as catalyst Pt-SAPO or US 5,849,960 using as catalyst Pd / ferrierite of US 5,510,306) in unit B(iii), and the effluent stream, 12, comprising linear paraffins and mid-chain methyl-branched internal olefins, is reacted in a process comprising one or more Oxo steps (unit(s) B(iv)) under conditions in which the hydroformylation reaction occurs preferably at a terminal carbon atom. B(iv) typically also includes means, not shown in the Figures, for reducing intermediate aldehydes to alcohols.

The resulting alcohol-rich stream, 13, in accordance with one embodiment of the invention, comprises a mixture rich in nonlinear primary aliphatic Oxo alcohols and which also contains Fischer-Tropsch Oxo hydrocarbons: the alcohols may be used directly as an additive in jet and / or diesel fuel, or may be distilled to cut out, for example, a mid-chain methyl branched primary detergent alcohol, 14, which can be sold to detergent manufacturers. Note that in the foregoing, Fischer-Tropsch Oxo hydrocarbons present in the alcohol-rich stream 13 can be separated by distillation, resulting in a hydrocarbon-stripped alcohol rich stream 14 and a Fischer-Tropsch Oxo hydrocarbon rich stream 15. This separation is greatly facilitated by the fact that the alcohol has a net gain of one carbon and one oxygen atom as compared to the hydrocarbon. Note also that streams such as 15 or 19, the latter of which also may include olefin dimers and / or diols, can simply be sent back to the main fuel distillation column, e.g., entering battery A at point (II) or battery A at point (I), or can be blended directly into distillate streams, e.g., 4-8. Similarly crackate waste streams 16 and 17 can be sent back to battery A, point (II), for distillation.

Fig. 3 differs from Fig. 2 in that it further nonlimitingly illustrates the detail of a blending battery, C, in which nonlinear primary aliphatic Oxo alcohol-rich stream 13 is blended with jet and / or diesel cuts to produce blend stocks. The blend stocks can be further diluted with fuel hydrocarbons from the present process or from other processes to provide other compositions of the invention, as described in more detail hereinafter.

In Fig. 4, crude F.T. wax 1 combined with a recycle stream 10 pass into a hydrocracking / hydroisomerization reactor as stream 2. Stream 23 is hydrogen. Stream 3 comprising hydrocracked, hydroisomerized hydrocarbons in the form of a broad range and mix of paraffins (e.g., C<sub>4</sub>-C<sub>30</sub> including methyl branched compounds) passes to a distillation section of the plant, A(ii). Distillation cuts from this section of the plant include streams suitable for jet 6, and diesel 8. A fraction from within an overall boiling range of C<sub>10</sub>-C<sub>20</sub>, preferably above C<sub>11</sub> e.g., C<sub>13</sub>-C<sub>16</sub>, is

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taken as a side-stream, 7, and is led to battery B for processing into nonlinear primary aliphatic alcohols (NLA's) as further defined elsewhere herein. A first stage in battery B is to secure a relatively narrow (two-carbon to four-carbon) heart cut with sharp boiling point initiation and cut-off. The tops and bottoms, streams 16 and 17, are blended back to appropriate mixing points (I, II, III, and IV) in battery A. The heart cut stream, 11, rich in random methyl-branched paraffins, is dehydrogenated in B(iii) to give a larger than conventional conversion of olefin (typically about 35%) along with some diolefin (up to about 10%). This is illustrative of what can be termed a "deep dehydrogenation" for the present purposes. Exhaust stream 18 carries off hydrogen and any low boiling crackates generated. Stream 12, rich in methyl-branched olefins, is optionally further processed via a diolefin-to-olefin hydrogenator such as a commercial DEFINE® type unit. Stream 12 or 13 carries output from the dehydrogenator, optionally via the DEFINE® hydrogenator, to an Oxo reactor unit or section of the plant, B(iv). In the latter, preferentially, the double bonds of internal olefins present are isomerized to become terminal and are hydroformylated to give a stream 14 comprising nonlinear primary aliphatic alcohols as defined further hereinafter and, as a majority component, methyl branched paraffins suitable for use as fuel F.T. Oxo hydrocarbons, which have been carried through the process. If needed, not shown but included in the Oxo reactor stage B(iv) is a polishing hydrogenation of the inherent intermediate aldehyde-to-alcohol step. Stream 20 is carbon monoxide / hydrogen gas. Crude stream 14 is suitable as a concentrated fuel additive (a "fungible" lubricant additive concentrate - i.e., one which is an economically interchangeable "standard material" for commerce), or (optionally as shown in Fig. 4 by the dashed line) for back blending into jet / diesel streams of battery A to form fungible blendstocks or finished fuels. If desired, and as shown in Fig. 4, a further distillation stage B(v) can be used to secure the nonlinear primary aliphatic Oxo alcohols essentially free from fuel hydrocarbons, stream 15, which can be useful, for example, to the manufacturers of detergents or other products. Recovered hydrocarbons 21 can be recycled and bottoms, 22, contain nonlinear diols which can be useful in and of themselves as fuel lubricants, and can be added into appropriate blending streams, or can be useful for other purposes, e.g., in detergents.

Fig. 5 represents a process rather similar to that described in connection with Fig. 2, with the exception or variation that an additional plant section or stage, B(vi) is present which is an olefin / paraffin separator, for example one relying on adsorptive separation on zeolites, e.g., an OLEX® unit. This unit can be used to increase the olefin / paraffin ratio in the stream entering Oxo reactor section B(iv). Thus, specifically, stream 12 in Fig. 5 as it enters the Oxo section B(iv) has a higher olefin / paraffin ratio than does stream 12 in Fig. 2 as it enters the Oxo section B(iv).

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Fig. 6 represents a process that has aspects which are similar to those described in connection with Fig. 2, but also some important differences. A major difference is that isomerization is done as a wax. This requires an additional wax isomerization unit, B(i), the output stream **10b** from which can be cracked in B(ii) to form highly branched alpha olefins, in stream 11. These are ideal for Oxo reaction by a non-isomerizing Oxo catalyst used in unit or section B(iv). Whereas in Fig. 2, the hydrocracking / hydroisomerization section of battery A is shown as one block, in Fig. 6, A(i) and A (ii) show isolated wax hydroisomerization and hydrocracking.